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Interactive comment on "The net exchange of methane with high Arctic landscapes during the summer growing season" *by* C. A. Emmerton et al.

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General Comments

This manuscript reports interesting data on land-atmosphere fluxes of CH4 from a high-arctic study area. The presented dataset comprises 5 years of CH4 flux chamber measurements at an arctic desert site, 3 years of CH4 flux chamber measurements at an adjacent wetland site, and 1 year of eddy covariance measurements at the same wetland site. Such an extensive CH4 flux dataset on from two nearby high-arctic landscape units is very valuable for the scientific field of the arctic biogeochemistry. Particularly relevant is the identification of the stable sink function of arctic desert for atmospheric CH4 which have not been shown so clearly before. The applied methods appear sound, and the results of high quality. The manuscript is very well written, and

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I have not found any orthographic mistakes. The tables and figures are well designed and have a high information density. The supplementary material is also very useful. I have only few specific and technical comments which I list below. I recommend the manuscript of Emmerton et al. for publication in Biogeosciences after minor revisions.

Specific comments

Page 1677, line 14: I suggest adding inserting “pronounced” or “considerable” before “diurnal patterns. People often underestimate radiation variability during polar day.

Page 1678, line 7: I suggest inserting “other” before “closed path detectors”. The TDL is also a closed path analyser.

Page 1679, lines 15-16: Please specify how long samples had to be stored before GC analysis. Has it been checked how stable the CH4 concentrations were over time in the bottles?

Page 1679, lines 24-25: Have you applied some approach of quality screening? I recommend not using the coefficient of determination as an indicator of chamber flux quality. R2 inherently will be always lower for small fluxes than for high fluxes. RMSE would be a more suitable statistical measure to evaluate the quality of a chamber flux measurement. We have given an expanded explanation on this topic here: Kutzbach et al. (2007). Biogeosciences 4: page 1019.

Page 1679, lines 27-28: I would add that the EC measurements supported this assumption (supplementary material).

Page 1680, first paragraph: Please provide some more information about the location of the tower with respect to the area of interest (at the eastern edge of the wetland) and about wind/footprint climatology. How often did the wind blow from a suitable direction? Have you filtered the time series for wind direction?

Page 1680, second paragraph: Have you considered applying the Burba correction for the CO2 fluxes?

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Page 1683, lines 7-9: This is unclear for me: Why multiple correlation for the relationship between CH4 consumption and soil temperature? Have you used several temperatures at several depths?

Page 1684, Eq. (1). The parameters in this empirical equation should have units. These would also clarify which units FCH4 and FCO2 have.

Page 1686, lines 19-23: Please make clearer in these sentences that you consider here soils that take up CH4 from the atmosphere. Methanotrophic activity behave differently in wetter soils. In these, often the highest methanotrophic activity is found in the upper part of the saturated soil zone.

Page 1687, lines 5-6: I do not think that these results can tell you so much about methogenic activity. It could be that the methanotrophic activity is just so efficient that the produced CH4 is anyway consumed, no matter if CH4 production is smaller of bigger.

Page 1688, line 10: I think that "even" is not appropriate. I would expect that the temperature effect on CH4 processes is probably particularly pronounced in cold environments.

Page 1689, second paragraph: The mineral soil horizons and also the through-flow nature of this wetland could lead to higher availability of electron acceptors as nitrate or Fe(II). It might be interesting to include this potential explanation in the discussion. In this context, you can have also a look to the following two papers: [Zona et al. (2009) Global Biogeochemical Cycles 23] and [Lipson et al. Biogeosciences 9].

Technical Comments

Page 1688, line 16: Insert "at" before "wetlands"

Page 1688, line 28: Correct "Eriophorum"

Interactive comment on Biogeosciences Discuss., 11, 1673, 2014.